

Measurement and Verification Guidelines For Energy Savings Performance Contracting

Comparing the after with the before to assess energy savings

Energy Savings Performance Contracting (ESPC) is all about saving measurable quantities of energy. Under an ESPC contract, an energy service company (ESCO) guarantees that after energy conservation measures (ECMs) are installed at a facility, energy use will be reduced by a quantifiable amount. In many respects, the success of an ESPC project hinges on verifying that the amount of energy saved closely matches the energy savings guaranteed in the ESCO's solicitation. The U.S. Department of Energy's Federal Energy Management Program (FEMP) has developed the *Measurement and Verification Guideline for Federal Energy Projects* to take the guesswork out of validating this before-and-after energy-use comparison.

Accurately verifying how ECMs perform is critical to both parties involved in an ESPC contract. For the government, verification confirms that the project is indeed a success and that energy and taxpayer money are being saved. For the ESCO, verification is the sole basis for the annual payments they receive throughout the term of the contract. By following the guideline, both parties are assured that savings will be accurately, consistently, and objectively verified.

The Guideline

The measurement and verification guideline was developed to give the Federal government and the ESCO industry mutually agreed-upon methods for assessing the energy savings derived from commonly installed ECMs. The guideline presents a set of flexible measurement and verification (M&V) options that the contracting parties can use to determine energy savings for all types of ESPC contracts.

The guideline is the first application of the North American Energy Measurement and Verification Protocol (NEMVP). (The 1997 version is expected to be called the International Measurement and Verification Protocol.) A committee—comprising the Federal government, the ESCO industry, academia, financing organizations, and others—developed the NEMVP over 3 years. The committee worked closely with a diverse group of engineers and contracting personnel to ensure the NEMVP was acceptable from both technical and contractual perspectives.

Because the guideline was developed to accommodate the concerns of all of the primary players in the

ESPC process, the procedures it specifies are impartial, reliable, and repeatable. Realizing that all ESPC projects are highly site specific, the guideline development committee built in flexibility, so the methods contained in the guideline are easily adapted to project-specific conditions. As a result, you can use the guideline with a high level of confidence, whether you are replacing a chiller in an office building in Fort Lauderdale or undertaking a lighting and boiler retrofit project in Seattle.

Baseline energy use and the allocation of risk

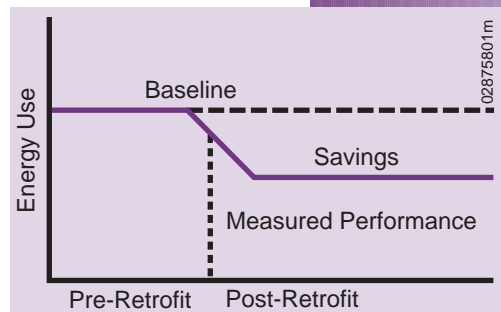
Before you can determine how much energy is being saved by ECMs, you have to know how much energy was being consumed before the ECMs were installed. This pre-ECM energy consumption is referred to as the baseline energy use, and it is the starting point for determining energy savings. The difference between the baseline energy use and the post-ECM-installation energy use is the actual project savings.

What happens, though, when the baseline conditions change after the ECMs are installed? Say, for example, that two shifts were operating in the building when the baseline was established; now—at some point after the ECMs have been installed—building occupancy is scaled back to one shift. Who takes responsibility when the conditions under which the baseline was established change? And how is contract compliance determined in the wake of such changes?

The guideline's standardized M&V procedures cover factors that can affect the baseline conditions, so valid before-and-after energy use comparisons can still be made. Three factors could affect a project's energy savings once it is up and running: (1) changes in baseline conditions (typically the owner's responsibility), (2) changes in equipment performance (ESCO's responsibility), and (3) changes in conditions out of the control of the owner or the ESCO (such as the weather).



What's New in Federal Energy Management



The Guideline shows how to use measured data to confidently assess energy savings.

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Collectively, such changes comprise the risk inherent within an ESPC contract. The guideline discusses who is responsible—the government or the ESCO—for shouldering the burden of these unforeseen changes. It also clearly allocates the risk associated with each party. By following the guideline, both the ESCO and the Federal agency involved in the ESPC contract understand where responsibility lies for ECM operation, maintenance, and performance throughout the life of the contract.

The three M&V options

ECMs vary substantially in their level of complexity. For example, for relatively straightforward lighting retrofit projects, assessing energy savings can often be accomplished with limited effort. On the other hand, projects that have a high degree of interaction among multiple energy-consuming systems—such as high-performance windows and automatic building controls—can be difficult to assess.

The guideline takes into account the varying complexity of ECM performance by providing three broad M&V options—referred to as Options A, B, and C—that can be used individually or in combination to determine the savings realized from any ECM, regardless of the complexity of its energy-saving mechanisms.

All three options are based, in part, on the ECM's "potential to perform," and verification begins by determining that the ECM is performing as expected. For example, if high-efficiency lighting is installed in a building, the ESCO guarantees the fixtures will perform to the levels specified by the manufacturer. A relatively simple monitoring program would then be used to verify that the lights are indeed performing as guaranteed.

Option A is the least complicated of the M&V options and is applied to projects in which the potential to perform needs to be verified, but the actual energy use can be determined through engineering calculations and statistical methods. Under Option A, verification entails ensuring that the installed ECMs meet the contractual performance specifications in terms of quantity, quality, and rating and that they continue to do so throughout the term of the contract. Option A does not involve long-term measurements, but regularly scheduled inspections and short-term metering or spot measurements will likely be conducted to ensure the performance goals are being met. In general, the performance of end-use-based ECMs such as lighting efficiency and fully loaded motors can be verified using Option A techniques.

Option B verifies the same items as Option A but also verifies actual achieved energy savings during the term of the contract using long-term or permanently installed metering/monitoring systems. Option B would be applied, for example, to verify the performance of ECMs whose energy use is affected by external variables such as weather patterns or inconsistent operating schedules. Depending on the operating environment, ECMs such as variable-speed drives and chillers would be likely candidates for Option B verification techniques. Essentially, Option B entails long-term measurements for capturing substantial operating variations that cannot be accurately assessed using the engineering and spot-metering techniques stipulated in Option A.

Option C determines energy savings at the whole-building level and is applied to projects in which the effect of the ECMs cannot be accurately assessed by measuring the before-and-after energy use of an isolated component or system. Option C is used, for example, when the ECMs installed interact extensively with each other, making the performance of a single ECM extremely difficult to quantify. Option C verification techniques involve whole-building metering using hourly performance data or utility billing data.

Selecting the proper M&V option for a project depends primarily on the site-specific conditions. Cost is also a factor. The M&V component of an ESPC contract should be scaled to the value of the project. Or put another way, the value of the information provided by a project's M&V procedures should be proportional to the value of the project. As a rule of thumb, M&V costs should fall within 3% to 10% of typical project cost savings.

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